(12) UK Patent Application (19) GB (11) 2 285 007 (13) A

(43) Date of A Publication 28.06.1995

(21) Application No 9422419.3

(22) Date of Filing 07.11.1994

(30) Priority Data
(31) 4343583 (32) 21.12.1993 (33) DE

(51) INT CL[6]
B25D 11/04

(52) UK CL (Edition N )
B4C C1A1 C1C C13 C5X

(56) Documents Cited
GB 2166381 A DE 003828309 A1

(58) Field of Search
UK CL (Edition M ) B4C
INT CL[5] B25D 11/00 11/04 17/06

(71) Applicant(s)
Robert Bosch & Co

(Incorporated in the Federal Republic of Germany)

D-70442, Stuttgart 30, Federal Republic of Germany

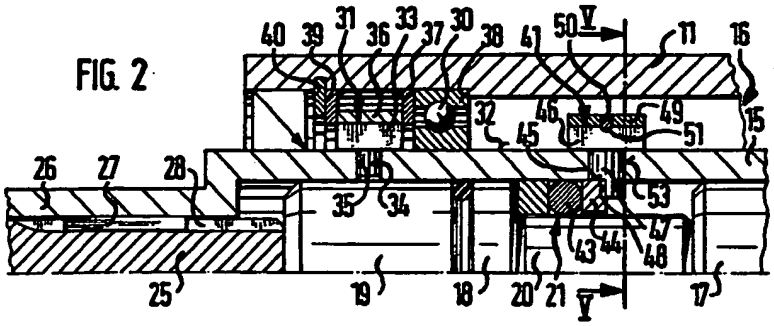
(72) Inventor(s)
Ulrich Muetschele
Karl Frauhammer
Gerhard Mebner
Heinz Schnerring
Volker Biermann

(74) Agent and/or Address for Service
A A Thornton & Co
Northumberland House, 303-306 High Holborn,
LONDON, WC1V 7LE, United Kingdom

(54) Hammer drill

(57) A hammer drill (10, Fig. 1) comprises a tool (14, Fig. 1) mounted in a holder (13, Fig. 1) and a motor driven striking mechanism 16 housed within a casing 11. A punch 19 is intermediate a tool shaft 25 and a striker 17 to transmit impulsive force to the tool. An axial stop 45 for a stop ring 44 of the striking mechanism 16 is formed by several bolt-shaped stop elements 41 distributed over the outer periphery 32 of the striker tube 15. The stop elements 41 each have a curved head portion 46 and a shaft portion 47 thereof passes through a recess 53 in the striker tube 15. Further bolt-shaped elements, designed as locking elements 31 serve to fix the striker tube 15 with respect to the casing 11.

FIG. 2




GB 2 285 007 A

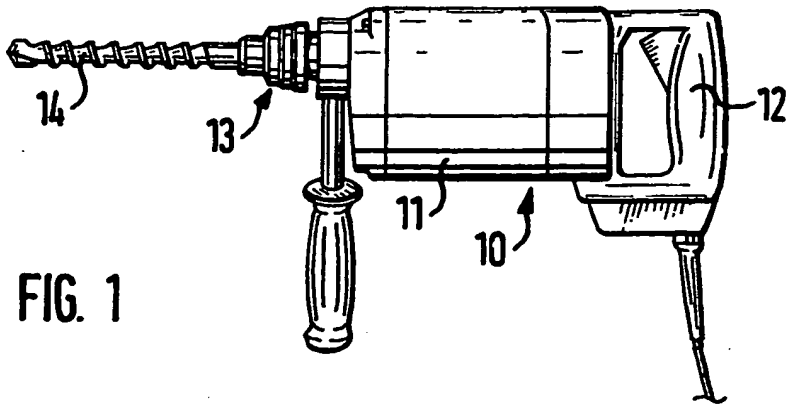



FIG. 1

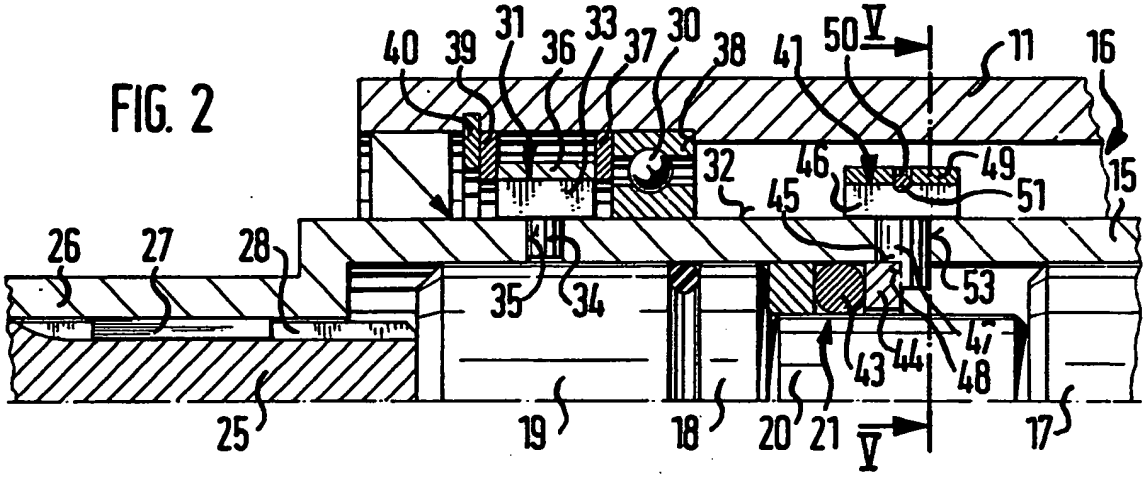



FIG. 2

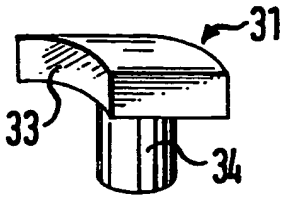



FIG. 3

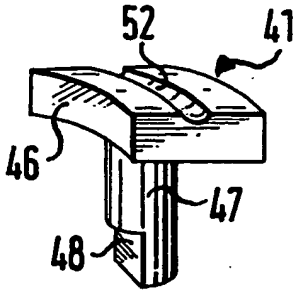



FIG. 4

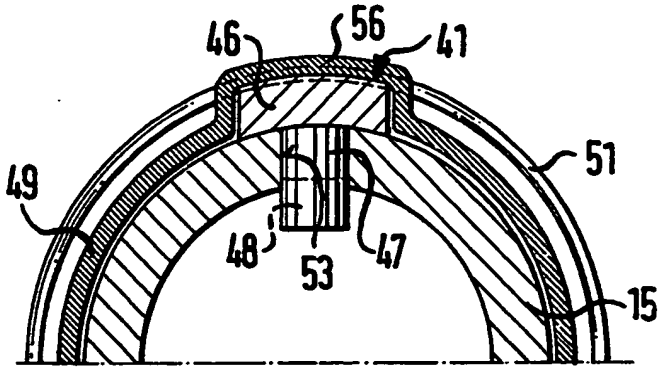



FIG. 5

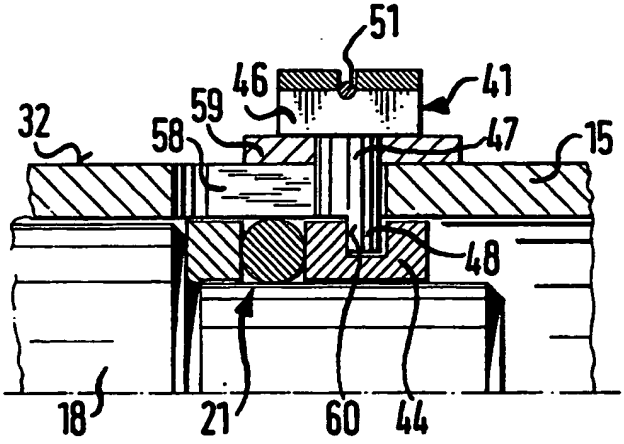



FIG. 6

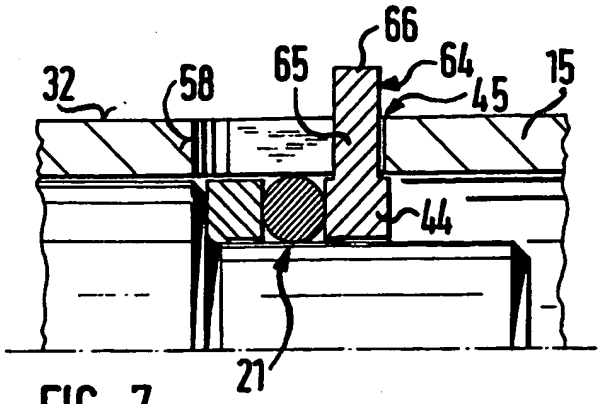



FIG. 7

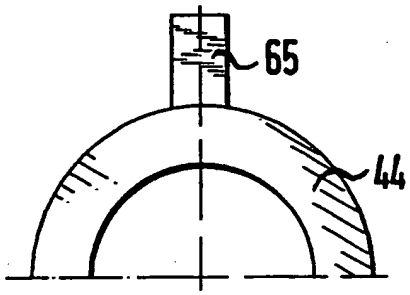



FIG. 8

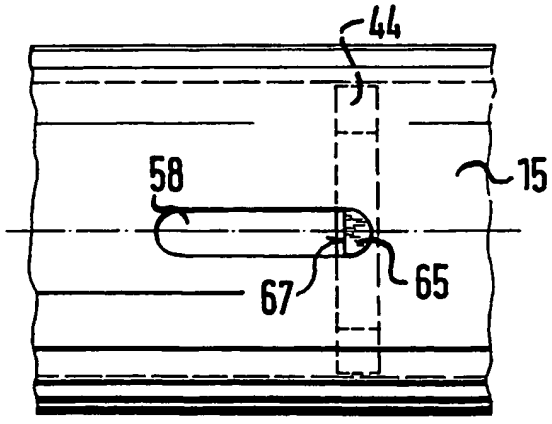



FIG. 9

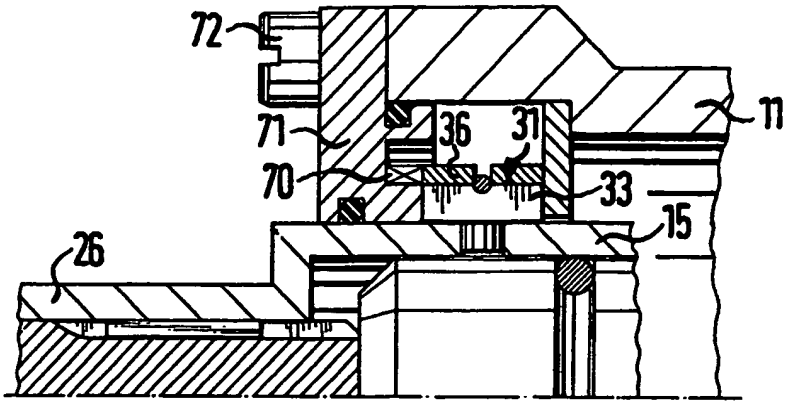

72
71
36
31
11
70
33
15
26

FIG. 10

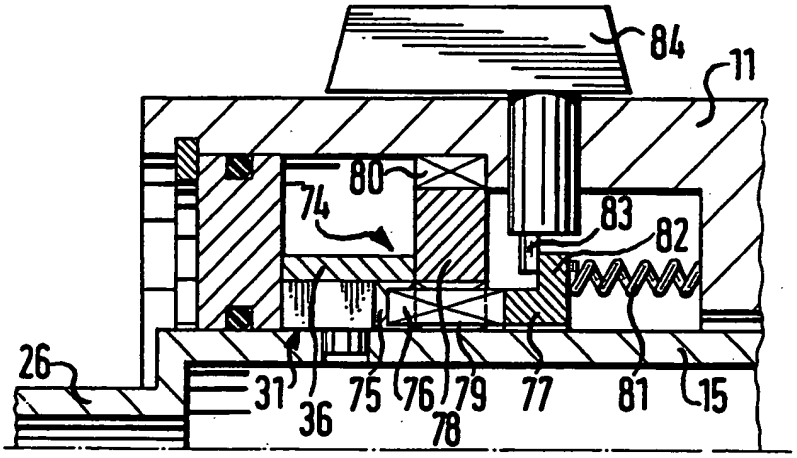

84
11
80
74
83
82
26
31
36
75
76
78
79
77
81
15

FIG. 11

2285007

# Hammer drill

## Prior art

The invention is based on a hammer drill according to the preamble to claim 1 or claim 8. Such a hammer drill is already known (DE 38 28 309 A1), in which a locking ring seated in an annular groove in the striker tube acts as an axial stop for an intermediate punch. In the outer periphery of the striker tube, further locking rings are arranged in annular grooves in the striker tube, which serve axially to fix the striker tube with respect to a casing of the hammer drill or other components with respect to the striker tube. The striker tube can be broken as a result of the reduction in cross-section and the notch effect at the annular grooves, particularly in the case of particularly powerful hammer drills, which is undesirable.

## Advantages of the invention

In contrast, the hammer drill according to the invention with the characterising features of claims 1 or claim 8 has the advantage that the intermediate punch or other components are fixable with respect to the striker tube, for the same wall cross-section of the striker tube, in a substantially more secure manner and without risk of breaking the striker tube. In addition, no annular grooves are required to fix the striker tube with respect to the casing.

The features listed in the sub-claims enable advantageous further developments and improvements of the hammer drill specified in claim 1 and claim 8.

Drawing

Embodiments of the invention are illustrated in the drawing and are explained in greater detail in the following description. Figure 1 shows a view of the hammer drill, figure 2 a section through the striker tube of the hammer drill according to figure 1, figure 3 a bolt-shaped element according to the invention for connecting the striker tube to the casing of the hammer drill, figure 4 a bolt-shaped element acting as an axial stop, figure 5 a section along the line V-V in figure 2, figure 6 a partial section through the striker tube, figure 7 a further embodiment of a bolt-shaped element, figures 8 and 9 show views of the bolt-shaped element according to figure 7 and figures 10 and 11 show further embodiments of bolt-shaped elements for fixing the striker tube with respect to the casing.

Description of the embodiments

A hammer drill designated with reference numeral 10 in figure 1 has a casing 11 having a handle 12 attached thereto. On the side opposite the handle 12, a tool chuck 13, into which a tool 14 can be inserted, projects out of the casing 11. Inside the casing 11 is a driving motor, which is not illustrated in greater detail, for driving the rotary and/or hammer action of the tool 14.

Figure 2 shows a half section through a striker tube 15 of the hammer drill 10. The striker tube 15 accommodates a striker 17 of a striking mechanism 16 in an axially displaceable manner. The striker 17 is drivable, moving axially in and out, in the striker tube 15 via any striking mechanism drive, for example via a swashplate drive disclosed in DE 38 28 309 A1. Connected to the striker 17 is an intermediate punch 18, which is aligned with the striker 17 and on which the striker exerts axial strokes during the hammer action of the hammer drill 10. A shaft 25 of the tool 14 (figure 1) is connected to the

intermediate punch 18, the shaft 25 being inserted into a tool chuck 26 of tool holder 13 (figure 1), which is integral with the striker tube 15. The intermediate punch 18 has a guiding portion 19, with which it is guided in the striker tube 15, and has, pointing towards the striker 17, a cylindrical extension 20 with an attached damping device 21 for the return stroke.

In the example, the striker tube 15 drivable in rotation by means of the driving motor, via a gear which is not shown in greater detail, and is pivotably mounted in the casing 11 in bearings, a roller bearing 30 of which is shown by way of example. The tool chuck 26 has strip-shaped rotary drivers 27 which engage in corresponding rotary driver grooves 28 provided in the tool shaft 25 for the purposes of driving the tool 14 in rotation.

In the embodiment according to figure 2, the striker tube 15 is not displaceable in the axial direction with respect to the casing 11. Several bolt-shaped elements, which are designed as locking elements 31, distributed over the periphery of the striker tube 15, serve axially to fix the striker tube 15. One of these locking elements 31 is illustrated in greater detail in figure 3. The locking element 31 has a curved head portion 33, corresponding to the outer wall 32 of the striker tube 15, and a cylindrical shaft portion 34, moulded thereupon in an integral manner. The locking elements 31 are each arranged on the striker tube 15 so that their shaft portion 34 projects into a corresponding recess, here a drilled hole 35, and their head portion 33 lies against the outer periphery 32 of the striker tube 15. In this position, they are held immovably in the radial direction by a peripheral safety washer 36, which has not yet been described in detail. The locking elements 31 thus represent fixed points of contact connected to the striker tube 15, which serve to fix the striker tube 15 with respect to the casing 11. Thus, the striker tube 15 is supported, via the locking elements 31, on the roller bearing

30, which, in turn, lies against an annular collar 38 of the casing 11. In the opposite direction, the striker tube 15 is also supported on the casing 11, via the locking elements 31, a disc 39 and a spring ring 40. Other components, e.g. springs, toothed wheels, etc, can also be fixed to the striker tube 15 by means of the locking elements 31.

Further bolt-shaped elements are designed as stop elements 41. The stop elements 41 are a portion of the damping device 21 and form an axial stop 45 for the intermediate punch 18. The damping device 21 serves to damp the return stroke of the intermediate punch 18 and has a stop ring 44, an annular body 42 and a damping body 43 made of a deformable material lying between the stop ring 44 and the annular body 42. In the axial direction towards the striker 17, the stop ring 44 is supported on the casing 11 via the stop element 41. Figure 4 shows a stop element 41, several of which are arranged in the peripheral direction on the outer periphery 32 of the striker tube 15. The stop element 41 is very similar to the locking element 31 in figure 3. It also has a curved head portion 46 corresponding to the outer wall 32 and a shaft portion 47 moulded thereupon in an integral manner. However, the shaft portion 47 is extended in the radial direction and projects through the wall of the striker tube 15 into the inside of the striker tube 15, wherein a flattened contact surface 48 for the stop ring 44 is provided at the end of the shaft facing away from the head portion 46. The contact surface 48 forms the axial stop 45 for the stop ring 44 and, via the damping device 21, for the intermediate punch 18. The stop elements 41 are also radially fixed by a safety washer 49. In the region of the head portions 46, each safety washer 49 has a slot 50, through which a peripheral locking ring 51 engages. The locking ring 51 is arranged in a groove 52, extending radially outwards in the centre of the head portion 46 of the stop elements 41, in the peripheral direction of the striker tube 15.

Figure 5 shows a section along the line V-V in figure 2. It shows a stop element 41, the shaft portion 47 of which is arranged in the drilled hole 53 in the striker tube 15. The contact surface 48 of the shaft portion 47 projects radially inwards in the striker tube 15. In the region of the head portion 46 of the stop element 41, the safety washer 49 has an enlarged portion 56 extending radially outwards over its otherwise cylindrical cross-section, in which the head portion 46 is accommodated. The stop element 41 is also radially fixed by the locking ring 51. In the embodiment in figure 5, two stop elements 41 are arranged, offset by 180° with respect to one another (not shown). However, further, for example a total of four stop elements 41, arranged offset by 90° with respect to one another, may be provided. The locking elements 31 (figures 2 and 3) are fixed by the safety washer 36 in a manner analogous to that shown in figure 5, although there is no additional locking ring in this case.

Figure 6 illustrates a further embodiment of a damping device 21. In contrast to the embodiment according to figure 2, the shaft portion 47 of the stop element 41 is arranged in a recess which is designed as a longitudinal hole 58. This is advantageous if, for example, the intermediate punch 18 is to be moved to a setting position facing away from the striker 17 for the purposes of switching off the striking mechanism. A sliding sleeve 59 is arranged between the head portion 46 and the outer periphery 32 of the striker tube 15, on which a grip for moving the stop elements 41, for example, can be placed.

Here, the stop ring 44 is widened in the axial direction and is provided with an annular groove 60 in which engages the contact surface 48 of the shaft portion 47.

Figure 7 shows a third embodiment of a damping device 21, in which the stop ring 44 itself is provided with bolt-shaped stop elements 64. In total, two opposing cylindrical shaft portions 65, only one of which is shown in the half-section,

are moulded onto the stop ring 44 in an integral manner and extend outwards in the radial direction. The shaft portions 65 pass through the longitudinal hole 58 and form the axial stop 45 therewith. An end 66, lying radially outside the outer periphery 32 of the striker tube 15 acts as the point of application for a sliding grip, which is not illustrated in greater detail.

Figure 8 illustrates a partial view of the stop ring 44 according to figure 7, which is provided with the cylindrical shaft portions 65, which are directed radially outwards.

Figure 9 shows a plan view of the striker tube 15, which contains the longitudinal hole 58. The stop ring 44, the shaft portion 65 of which, here provided with a flattened portion 67, engages in the longitudinal hole, is illustrated by the dashed line on the inside of the striker tube 15. To assemble the stop ring 44 according to figures 7 to 9, the stop ring 44 is pushed obliquely into the striker tube 15 and is aligned in the longitudinal holes 58.

Figure 10 shows a variant embodiment in which the locking element 31 according to figures 2 and 3 is also fixed to the casing 11 in the peripheral direction, in addition to the axial fixing of the striker tube 15. This is necessary if, for example, driving of the striker tube 15 in rotation is not required and the striker tube 15 is intended to be torsionally rigid with respect to the casing 11 (e.g. in purely chisel hammers). The locking element 31 is fixed in the peripheral direction by means of the safety washer 36, which, in a manner analogous to figure 5, grips the head portion 33 of the locking element 31 with the enlarged portion 56. The side of the safety washer 36 facing the tool chuck 26 is provided with gearing 70, which constantly engages in corresponding gearing of a flange 71 which is fixed to the casing. The flange 71 is screwed to the casing 11 via screws 72. In this manner, the

striker tube 15 is permanently secured against twisting in the peripheral direction.

The embodiment of a locking apparatus 74 illustrated in figure 11 has several locking elements 31, one of which is illustrated. The locking elements 31 are also held via a safety washer 36. Gearing 75 is provided on the side of the head portion 33 of the locking elements 31 facing away from the tool chuck 26. In the illustrated locked position, the gearing 75 engage in gearing 76 of a switching sleeve 77. The switching sleeve 77, in turn, is fixed to prevent twisting with respect to the casing 11 of the hammer drill, in that a toothed disc 78 with locking gearing 79 engages in the opposing gearing 76 and, on the other hand, is fixed to prevent twisting with respect to the casing 11 via outer gearing 80. The switching sleeve 77 is displaceable with respect to the striker tube 15 in the axial direction and is, on the one hand, stressed in the direction of the tool chuck 26 by a spring 81, so that the gearings 75 and 76 are held engaging in one another. On the other hand, a collar 82 of the switching sleeve 77 lies against a switching knob 83 of a switching grip 84, which is pivotably held in the casing 11 and the axis of rotation of which is eccentric to the switching knob. Twisting of the switching grip 84 through 180° enables the switching knob 83 to be moved into its opposite eccentric position, through which the switching sleeve 77 is pushed against the force of the spring 81 and the gearings 75, 76 disengage. The striker tube 15 can then be freely twisted with respect to the casing 11. Depending on the number of teeth of the gearings 75 and 76, the striker tube 15 can then be moved into various rotary positions and locked with respect to the casing 11 by means of the switching grip 84.

It should be noted that the same parts or parts with the same effect are characterised by the same reference numerals in all the illustrated embodiments.

Claims

1. Hammer drill having a tool holder (13) and a motor-driven striking mechanism (16), accommodated in a casing (11), the striking mechanism (16) having a driveable striker (17), moving axially in and out in a striker tube (15), which during the hammer action exerts strokes on an intermediate punch (18), which is arranged in the striker tube (15) between the striker (17) and a tool shaft (25) which is insertable into the tool holder (13) and is axially displaceable within limits with respect to the striker tube (15), wherein its displaceability in the axial direction towards the striker (17) is limited by an axial stop (45), characterised in that the axial stop (45) is formed by at least one stop element (41) which is provided with a shaft portion (47, 65), which engages in an allocated recess (53, 58) in the wall of the striker tube (15).

2. Hammer drill according to claim 1, characterised in that the intermediate punch (18) has a cylindrical guiding portion (19) lying closer to the tool holder (13) and a cylindrical extension (20) lying closer to the striker (17), the cylindrical extension (20) being of smaller diameter than the guiding portion (19), wherein a damping device (21) for a return stroke of the intermediate punch (18) is arranged on the outer periphery of the extension (20), which has, in addition to the axial stop (45), a stop ring (44) and a deformable damping body (43) located

between the stop ring (44) and the intermediate punch (18).

3. Hammer drill according to claim 1 or 2, characterised in that the recesses are formed by axially delimited longitudinal grooves (58).

4. Hammer drill according to claim 2, characterised in that the shaft portion (47, 65), of which there is at least one, of the stop element (41), of which there is at least one, is integral with the stop ring (44) itself.

5. Hammer drill according to one of claims 1 to 3, characterised in that the stop element (41), of which there is at least one, has a head portion (46), which is curved corresponding to the outer periphery (32) of the striker tube (15) and is moulded in an integral manner onto the shaft portion (47), wherein the shaft portion (47) passes inwards through the recess (53, 58) and, with an end of the shaft facing away from the head portion (46), forms the axial stop (45) for the stop ring (44).

6. Hammer drill according to claim 5, characterised in that the stop element (41), of which there is at least one, is radially held by a peripheral safety washer (49), each of which has an enlarged portion (56) extending radially outwards in the region of the head portion (46) of the stop element (41) for accommodating the head portion (46) and grips the stop element (31) in the peripheral direction of the striker tube (15).

7. Hammer drill according to claim 4, characterised in that a groove (52), in which a peripheral safety ring (51) is arranged, is provided in the head portion (46) of the bolt, viewed in the peripheral direction of the striker tube (15).

8. Hammer drill having a motor-driven striking mechanism (16), accommodated in a casing (11), and a striker tube (13) mounted in the casing (11), in which a striker (17) is guided, moving axially in and out, characterised in that at least one locking element (31) is arranged on the outer periphery (32) of the striker tube (15), by means of which the striker tube (15) is fixable with respect to axial displaceability or rotatability with respect to the casing (11) and/or further components are fixable with respect to the striker tube (15), wherein the locking element (31), of which there is at least one, is provided with a shaft portion (34) which engages in an allocated recess (35) in the striker tube (15).

9. Hammer drill according to claim 8, characterised in that the locking element (31), of which there is at least one, is radially held by a safety washer (36), each of which has, in the region of the head portion (33) of the locking element (31), an enlarged portion (56), directed radially outwards, for receiving the head portion (33) and grips the locking element (31) in the peripheral direction of the striker tube (15).

10. Hammer drill according to claim 8 or 9, characterised in that gearing (70, 75) is provided on the head portion (33) or on the safety washer (36), the gearing (70, 75) being engageable with opposing gearing (76) which is fixable to the casing (11) in a torsionally rigid manner.

11. Any of the hammer drills substantially as herein described with reference to the accompanying drawings.

| Patents Act 1977<br>Examiner's report to the Comptroller under Section 17<br>(The Search report) | Application number<br>GB 9422419.3 |
|---|---|
| Relevant Technical Fields<br><br>(i) UK Cl (Ed.M) B4C<br><br>(ii) Int Cl (Ed.5) B25D (11/00, 04; 17/06) | Search Examiner<br>H F YOUNG<br><br>Date of completion of Search<br>20 DECEMBER 1994 |
| Databases (see below)<br>(i) UK Patent Office collections of GB, EP, WO and US patent specifications.<br><br>(ii) | Documents considered relevant following a search in respect of Claims :-<br>1-7 |

**Categories of documents**

| | | | |
|---|---|---|---|
| X: | Document indicating lack of novelty or of inventive step. | P: | Document published on or after the declared priority date but before the filing date of the present application. |
| Y: | Document indicating lack of inventive step if combined with one or more other documents of the same category. | E: | Patent document published on or after, but with priority date earlier than, the filing date of the present application. |
| A: | Document indicating technological background and/or state of the art. | &: | Member of the same patent family; corresponding document. |

| Category | Identity of document and relevant passages | | Relevant to claim(s) |
|---|---|---|---|
| Y | GB 2166381 A | (TECNEDIL) see Figure 1 | 1 |
| Y | DE 3828309 A1 | (BOSCH) see Figures 2 and 3 | 1 |

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).